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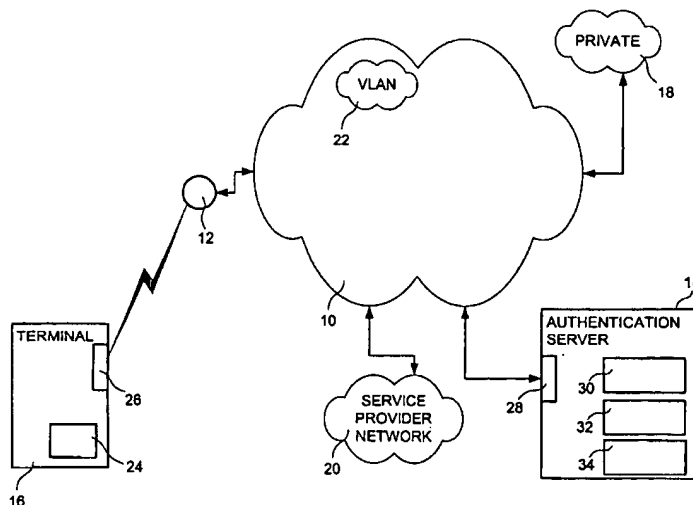
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(54) Title: METHOD, SYSTEM AND DEVICE FOR SERVICE SELECTION VIA A WIRELESS LOCAL AREA NETWORK



(57) Abstract: A method in a system, a system, a method in a terminal and a terminal for service selection in a data network. The method comprising sending, from a WLAN terminal, a network access identifier (NAI) including a service selection indicator via a WLAN access point, receiving, at an authentication server, the network access identifier including a service selection indicator, providing the WLAN terminal with a connection to the service that is indicated by said selection indicator. The system comprising at least one Wireless local Area Network (WLAN) access point, at least one WLAN terminal comprising means for including a service selection indicator in a Network Access Identifier (NAI) and means for sending said NAI including said service selection indicator via The WLAN access point, at least one authentication server comprising means for receiving a NAI including said service selection indicator, means for extracting said service selection indicator from said NAI and means for initiating a connection to a service indicated by said service selection indicator.



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METHOD, SYSTEM AND DEVICE FOR SERVICE SELECTION VIA A  
WIRELESS LOCAL AREA NETWORK

Technical Field of the Invention

The invention relates to a method in a system and a system for service selection via a Wireless Local Area Network (WLAN). Further, the invention relates to a  
5 method in a terminal, a terminal, and a computer program.

Background of the Invention

Today, communication and access to information or  
10 specific networks via various types of data networks is important. By introducing Wireless Local Area Networks (WLAN) communication and accessing information or networks has become easier and more flexible. One example of a WLAN is defined in the IEEE 802.11 standard. For  
15 example, a person that wants to get a connection via a network does not need to search for an unoccupied network socket and may freely choose the location where he want to be when connecting to the network, as long as the WLAN signals reaches this location.

20 However, when it comes to selecting different services, or views, the network system or a service provider decide the service accessible from a terminal connecting to the WLAN based on the identity of the terminal. In the context of this application a service is  
25 a network environment that the WLAN terminal is or will be connected to, for example the service may be a local network, a private network, the Internet, a specific service provider provided network, virtual local area networks, etc. Thus, a WLAN terminal that is connecting  
30 to a network is restricted to a service predetermined by the network system or the service provider, even if the WLAN is able to provide connections to different services.

Summary of the Invention

It is an object of the present invention to provide an improved WLAN system facilitating selection of various  
5 services.

This object is accomplished by means of a method for service selection according to claim 1, a system for selecting services in a network according to claim 6, a method in a terminal according to claim 9, a computer  
10 program according to claim 15, a terminal according to claim 16, an authentication server according to claim 21, and a method in an authentication server according to claim 25. Preferred embodiments of the invention are disclosed in the dependent claims.

15 More particularly, according to one aspect, a method for service selection in a data network comprising at least one Wireless Local Area Network (WLAN) access point, comprises:

20 sending, from a WLAN terminal, a network access identifier (NAI) including a service selection indicator via the WLAN access point,

receiving, at an authentication server, the network access identifier including a service selection indicator,

25 providing the WLAN terminal with a connection to the service that is indicated by said selection indicator.

According to another aspect, a system for selecting services in a network comprises:

30 at least one Wireless Local Area Network (WLAN) access point,

at least one WLAN terminal comprising means for including a service selection indicator in a Network Access Identifier (NAI) and means for sending said NAI  
35 including said service selection indicator via the WLAN access point,

at least one authentication server comprising means for receiving a NAI including said service selection indicator, means for extracting said service selection indicator from said NAI and means for initiating a  
5 connection to a service indicated by said service selection indicator.

According to a further aspect, a method in a terminal for selecting services comprises:

setting a service selection indicator,  
10 including said service selection indicator in a Network Access Identifier (NAI),  
sending said NAI including said service selection indicator over a Wireless Local Area Network (WLAN),  
receiving at least one message for establishing a  
15 connection to the indicated service.

According to yet a further aspect, a terminal that is enabled for communication via a Wireless Local Area Network (WLAN) comprises:

means for setting a service selection indicator,  
20 means for including said service selection indicator in a Network Access Identifier (NAI),  
means for sending said NAI including said service selection indicator,  
means for establishing a connection to a indicated  
25 service in response to at least one message for establishing a connection.

According to yet another aspect, an authentication server comprises means for receiving a Network Access Identifier (NAI) including a service selection indicator,  
30 means for extracting said service selection indicator from said NAI, and means for initiating a connection between a WLAN terminal and a service indicated by said service selection indicator.

According to a further aspect, a method in an  
35 authentication server comprises receiving a Network Access Identifier (NAI) including a service selection indicator, extracting said service selection indicator

from said NAI, and initiating a connection between a WLAN terminal and a service indicated by said service selection indicator.

In the context of the invention the NAI is an  
5 identifier comprising the identity identifying the WLAN terminal and/or an identity identifying the user. Further the NAI comprises an identity identifying an authentication server that are to be used for establishing a connection.

10 By including said service selection indicator in a NAI it becomes possible to select a service from the WLAN terminal. Thus, the user becomes free to make a selection of service, if the user or WLAN terminal is entitled to do so. Further, a NAI is used in common WLAN protocols in  
15 order to enable roaming and by including the selection indicator in the NAI the selection indicator may be sent via the WLAN using existing protocols for such communication. Thus, the service providers are able to provide service selection capability in existing or  
20 future WLAN systems without to much extra effort.

In one embodiment the NAI is of the form  
<user>@<realm>. In such NAI the service selection indicator may be included in the <realm> portion of the NAI.

25 In another embodiment an Authentication Authorization Accounting (AAA) protocol is used for the communication to the WLAN terminal. The use of an AAA protocol in combination with the service selection indicator may facilitate provision of billable services.  
30 Thus, possibly making service providers more eager to provide a plurality of services resulting in a greater freedom for users to select services.

In yet another embodiment tunnel attributes relating to an indicated service may be provided to the WLAN  
35 terminal. This makes it possible provide the user with any type of service that can be tunneled.

In a further embodiment Virtual Local Area Network (VLAN) attributes relating to an indicated service may be provided to the WLAN terminal. This makes it possible to connect the user to a user selected VLAN.

5 In one embodiment the user identity, the service selection indicator, and a billable feature is logged in facilitate administration of billing of services utilized by the user having said user identity.

A further scope of applicability of the present  
10 invention will become apparent from the detailed description given below. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various  
15 changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

#### Brief Description of the Drawings

20 Other features and advantages of the present invention will become apparent from the following detailed description of a presently preferred embodiment, with reference to the accompanying drawings, in which

Fig. 1 is an schematic overview of one embodiment of  
25 an improved system, a improved WLAN terminal and an improved authentication server,

Fig. 2 is a schematic block diagram of one embodiment of the WLAN terminal in Fig. 1,

Fig. 3 is a flowchart of a service selection process  
30 in one embodiment of the WLAN terminal in Fig. 1,

Fig. 4 is a schematic block diagram of one embodiment of the authentication server in Fig. 1,

Fig. 5 is a flowchart of a service selection process in one embodiment of the authentication server in Fig. 1,

35 Fig. 6 is a timing diagram of one embodiment of the system in Fig. 1.

Detailed Description of an Embodiment

In Fig. 1 an schematic overview of a network system in which the invention may be used is shown. The system comprises a data network 10, a Wireless Local Area  
5 Network (WLAN) access point 12, an authentication server 14 and a WLAN terminal 16. The network 10 may be a Local Area Network (LAN), a Wide Area Network (WAN), the Internet, a wireless network, a wired network, etc. The WLAN access point 12 enable network communication from  
10 the WLAN terminal 16, which is arranged to communicate using WLAN protocols. The WLAN terminal 16 may be any WLAN enabled terminal, for example, a lap top, a personal digital assistant (PDA), cellular telephone, etc. The WLAN may be any type of WLAN that enables the WLAN  
15 terminal 16 to provide its identity and/or the identity of the user to the network 10 and that enables the WLAN terminal 16 to provide the identity of an authentication server 14 that are to be used to the network 10. For example, a WLAN according to IEEE 802 standard, WPAN,  
20 Bluetooth, Home RF, or HIPERLAN. In the context of the invention an identifier providing the above mentioned identities is called a Network Access Identifier (NAI).

The authentication server 14 is a system for authorizing access to a service and is provided by a  
25 service provider. The authentication server 14 includes a network connection means 28, means 30 for authenticating a WLAN terminal, means 32 for extracting a service selection indicator from a received NAI, and means 34 for providing connection attributes corresponding to a  
30 selected service. In one embodiment the authentication server 14 may be an Authentication Authorization Accounting Server.

A service provider is a company, an organization or a department that provides access to one or a plurality  
35 of network environments, for example, a local network 10, a private network 18, the Internet 10, a specific



network 20 provided by the service provider, virtual local area networks (VLAN) 22, etc.

The WLAN terminal 16 comprises means 24 for adding a service selection indicator to a NAI and a WLAN  
5 transceiving means 26 for sending data packets to and receiving data packets from a WLAN access point 12.

In Fig. 2 there is shown a schematic view of an embodiment of a WLAN terminal 200. The WLAN terminal comprises WLAN transceiving means 202. The transceiving  
10 means 202 comprises a protocol stack including protocols for handling the communication, the stack may include parallel protocols for communications according to different communication standards or communication methods. At least one protocol at the data link layer,  
15 according to the Open System Interconnection (OSI) reference model, ISO 7498, is arranged to include a NAI in a data packet for transmission to the WLAN access point.

According to one embodiment, the WLAN terminal  
20 comprises input means 204 and service selector means 206. The service selector means 206 is arranged to receive an input from the input means 204 and include a service selection indicator in the NAI. The input received from the input means 204 may, for example, be the complete  
25 service selection indicator that is to be included in the NAI or it may be a reference to a service selection indicator stored in the WLAN terminal 200. In the latter case the service selector means 206 retrieves the complete service selection indicator and includes it in  
30 the NAI. The input means 204 may, for example, be a keyboard, a scanner, a pressure sensitive surface, a microphone combined with voice recognition, a pointing device etc.

In one embodiment the WLAN terminal 200 comprises  
35 display means 208. In such embodiment the service selector means 206 may be arranged to present a list of services to select from.

In an embodiment, in which the WLAN operates according to IEEE 802, the NAI may look like <username>@<realm>. The <username> is the identity of the user and/or the WLAN terminal and the <realm> is the  
5 identity of the authentication server that is to handle the service request from the terminal. Such NAI may, for example, look like name@serviceprovider.com. The service selection indicator may be inserted anywhere in the NAI. In one embodiment the service selection indicator is  
10 inserted between the "@" and the <realm>, i.e. <username>@<service selection indicator><realm>, but the service selection indicator may be inserted anywhere in the NAI.

In Fig. 3 there is shown a flowchart of the service  
15 selection process in one embodiment of a WLAN terminal. The WLAN terminal starts with presenting a list of services on the display device, step 300. Then a user of the WLAN terminal is able to make a selection from said list of services, step 302. The user may do the selection  
20 by inputting a reference number referring to the desired service in the list, by pointing and clicking at the desired service, by speaking a reference to a selection into a microphone, etc. From the selection made by the user a reference to the selected service is generated and  
25 by means of this reference the WLAN terminal retrieves and sets a service selection indicator, step 304. Then the WLAN terminal insert the service selection indicator into the NAI, step 306. When the service selection indicator is inserted in the NAI the WLAN terminal sends  
30 the service request, included in the NAI, over the WLAN, step 308.

Now referring to Fig. 4 and Fig. 5. In Fig. 4 one embodiment of the authentication server 400 is schematically shown and in Fig. 5 an flowchart over the  
35 service selection process in one embodiment of the authentication server 400 is shown. The authentication server 400 includes a network connection means 402 for

communication over the network 403 that it is connected to. The network 403 may, for example, be a Local Area Network (LAN), a Wide Area Network (WAN), the Internet, a wireless network, a wired network, etc. Via the network connection 402 the authentication server 400 receives a data packet carrying a NAI including a service selection indicator, step 502. The NAI is passed to an authentication processing means 404, step 504. The authentication processing means 404 comprises means 406 for extracting a service selection indicator from a NAI. The means 406 for extracting a service selection indicator extracts the service indicator from the NAI, step 506. Then the authentication processing means 404 access a database 408 including information regarding who or which devices and/or users that are authorized to connect to specific services, step 508. The database 408 may be provided within the authentication server or as one or a plurality of external databases connected directly to the authentication server or via the network connection. Thus, the authentication server 404 utilizes the identity included in the NAI and the service selection indicator to determine whether the sender of the NAI is authorized to connect to the service that the service selection indicator points out or not, step 509. If the sender is not authorized to connect to the service, then a message indicating that the authorization for the requested service has failed is sent to the requesting WLAN terminal, step 510. However, if the sender is authorized to connect to the service, then the authentication server initiate the connection of the WLAN terminal to the service, step 512, for example, by sending to the WLAN terminal the attributes necessary for setting up the connection.

In Fig. 6 there is shown an example timing diagram of one embodiment. In the timing diagram the Extensible Authentication Protocol (EAP) and the access control protocol called "Remote Authentication Dial-In User

Service" (RADIUS) is used, however, any protocol resulting in corresponding functionality may be used, e.g. Diameter, which is a protocol developed from the RADIUS protocol, or any future Authentication

5 Authorization Accounting protocol (AAA-protocol). The WLAN access point starts with requesting the identity of the user/WLAN terminal. For this purpose the access point sends an EAP-Request/Identity packet, 602, to the WLAN terminal. The WLAN terminal responds with an EAP-

10 Response/Identity packet 604, which includes the NAI including the service selector indicator. The WLAN access point then sends a RADIUS Access-Request packet 606, which includes the NAI including the service selector indicator, to the authentication server. When the

15 authentication server has received the RADIUS Access-Request packet 606 it checks whether the terminal and/or the user is authorized to connect to the requested service or not. If the user/terminal is not authorized, then the authentication server refuses the connection

20 attempt.

However if the user/terminal is authorized, then the authentication server sends a RADIUS Access-Challenge packet 608, including an EAP-request, to the WLAN Access point. When the RADIUS Challenge-Challenge packet 608 is

25 received at the WLAN Access point, the WLAN Access point sends an EAP-request packet 610, including the above mentioned EAP-request, to the WLAN terminal. The WLAN terminal responds to this packet 610 by sending an EAP-response packet 612 to the WLAN access point, which then

30 sends a RADIUS Access-Request packet 614, including the EAP-response, to the authentication server. The procedure of sending packets 608, 610, 612, and 614 may be repeated N number of times. The value of N varies depending on the authentication method used.

35 The authentication is completed either as a failure, if the WLAN terminal and/or user failed the authentication process, or as a success, if the WLAN

terminal was successfully authenticated. If the authentication is a failure the authentication server sends a failure packet to the WLAN terminal via the WLAN access point. However, if the authentication is a success  
5 the authentication server retrieves the network attributes needed for providing a connection in accordance with the service that was requested by means of the service selector indicator. For example, the network attributes may be tunnel attributes for a Virtual  
10 LAN identifier, which directs the data packets of the WLAN terminal to a specific Virtual LAN. Then the authentication server sends a RADIUS Access-Accept packet 616, including the network attributes for the requested service, to the WLAN access point. The WLAN  
15 access point then provides the WLAN terminal with an EAP-Success packet 618, and now the WLAN terminal has access to the requested service.

By making services selectable for a user and by utilizing an AAA-protocol, e.g. RADIUS, a service  
20 provider may easily create, provide and log billable services and a user may get access to an increasing number of services. For example, it is possible to generate a log of every user and the services the user has utilized. An indicator of the selected service and  
25 the identity of the user is sent to the access server by means of the NAI and is thus easily registered in the log. Further, the identity of the user/terminal may be confirmed by means of an authentication process, such process may utilize a signaling scheme generating packets  
30 corresponding to the packets 608, 610, 612, 614 in Fig. 6. Additional, a billable feature is measured and registered in the log, such billable feature may be a time interval during which the service has been used, an amount of data transferred to, from or both to and from  
35 the WLAN terminal, the number of times the service has been used, etc. The log may then be used by the service provider for billing the user.

In one embodiment the functionality of the WLAN terminal and the authentication server may be implemented by means of software code that are arranged to be run in the WLAN terminal and the authentication server,  
5 respectively.

## CLAIMS

1. Method for service selection in a data network  
5 comprising at least one Wireless Local Area Network  
(WLAN) access point, said method comprising:  
    sending, from a WLAN terminal, a network access  
    identifier (NAI) including a service selection indicator  
    via the WLAN access point,  
10      receiving, at an authentication server, the network  
    access identifier including a service selection  
    indicator,  
    providing the WLAN terminal with a connection to the  
    service that is indicated by said selection indicator.
- 15      2. Method according to claim 1, wherein the NAI is  
    of the form <user>@<realm> and the service selection  
    indicator is included in the <realm> portion of the NAI.
3. Method according to any one of claim 1 or 2,  
    wherein communication to and from said WLAN terminal  
20      utilizes an Authentication Authorization Accounting (AAA)  
    protocol.
4. Method according to any one of claims 1-3,  
    wherein said providing the WLAN terminal with a  
    connection includes transferring tunnel attributes to  
25      said WLAN terminal.
5. Method according to any one of claims 1-4,  
    wherein said providing the WLAN terminal with a  
    connection includes transferring Virtual Local Area  
    Network attributes to said WLAN terminal.
- 30      6. A system for selecting services in a network, the  
    system comprising:  
    at least one Wireless Local Area Network (WLAN)  
    access point,  
    at least one WLAN terminal comprising means for  
35      including a service selection indicator in a Network  
    Access Identifier (NAI) and means for sending said NAI

including said service selection indicator via the WLAN access point,

at least one authentication server comprising means for receiving a NAI including said service selection indicator, means for extracting said service selection  
5 indicator from said NAI and means for initiating a connection to a service indicated by said service selection indicator.

7. A system according to claim 6, wherein said means  
10 for initiating a connection is arranged to send tunnel attributes relating to said connection.

8. A system according to any one of claims 6-7, wherein said means for initiating a connection is arranged to send Virtual Local Area Network (VLAN)  
15 attributes relating to said connection.

9. A method in a terminal for selecting services, said method comprising:

setting a service selection indicator,  
including said service selection indicator in a  
20 Network Access Identifier (NAI),  
sending said NAI including said service selection indicator over a Wireless Local Area Network (WLAN),  
receiving at least one message for establishing a connection to the indicated service.

25 10. Method according to claim 9, further comprising receiving an input from the user indicating a selected service.

11. Method according to any one of claims 9-10, further comprising presenting selectable services for a  
30 user.

12. Method according to any one of claims 9-11, wherein the NAI is of the form <user>@<realm> and the service selection indicator is included in the <realm> portion of the NAI.

35 13. Method according to any one of claims 9-12, wherein said receiving at least one message establishing



a connection further comprises receiving tunnel attributes for use in establishing the connection.

14. Method according to any one of claims 9-13, wherein said receiving at least one message establishing  
5 a connection further comprises receiving Virtual Local Area Network (VLAN) attributes for use in establishing the connection.

15. A computer program directly loadable into the internal memory of a terminal, the computer program  
10 comprising software code portions for performing the method of any one of claims 9-14.

16. A terminal that is enabled for communication via a Wireless Local Area Network (WLAN), said terminal comprising:

15 means for setting a service selection indicator,  
means for including said service selection indicator in a Network Access Identifier (NAI),  
means for sending said NAI including said service selection indicator,  
20 means for establishing a connection to a indicated service in response to at least one message for establishing a connection.

17. Terminal according to claim 16, further comprising input means for input of an indicator of a  
25 selected service.

18. Terminal according to any one of claims 16-17, further comprising means for presenting selectable services for a user.

19. Terminal according to any one of claims 16-18, wherein said means for establishing a connection is  
30 arranged to establish a connection based on received tunnel attributes.

20. Terminal according to any one of claims 16-19, wherein said means for establishing a connection is  
35 arranged to establish a connection based on received Virtual Local Area Network (VLAN) attributes.

21. An authentication server comprising:  
means for receiving a Network Access Identifier  
(NAI) including a service selection indicator,  
means for extracting said service selection  
5 indicator from said NAI, and  
means for initiating a connection between a WLAN  
terminal and a service indicated by said service  
selection indicator.

22. Authentication server according to claim 21,  
10 further comprising means for retrieving attributes for  
setting up a connection to the service indicated by said  
service selection indicator.

23. Authentication server according to any one of  
claims 21-22, wherein the authentication server is a  
15 authentication authorization accounting server.

24. Authentication server according to any one of  
claims 21-23, further comprising a log including at least  
one record, which includes a user identity, a service  
selection indicator, and a value representing a billable  
20 feature.

25. A method in an authentication server comprising:  
receiving a Network Access Identifier (NAI)  
including a service selection indicator,  
extracting said service selection indicator from  
25 said NAI, and  
initiating a connection between a WLAN terminal and  
a service indicated by said service selection indicator.

26. Method according to claim 25, wherein said  
initiating a connection comprises sending connection  
30 attributes related to the service that is indicated by  
said service selection indicator.

27. Method according to any one of claims 25-26,  
further comprising controlling if a user identified in  
the NAI is authorized to access the service indicated in  
35 the NAI.

28. Method according to any one of claims 25-27, further comprising logging a billable feature for an identified user utilizing an indicated service.

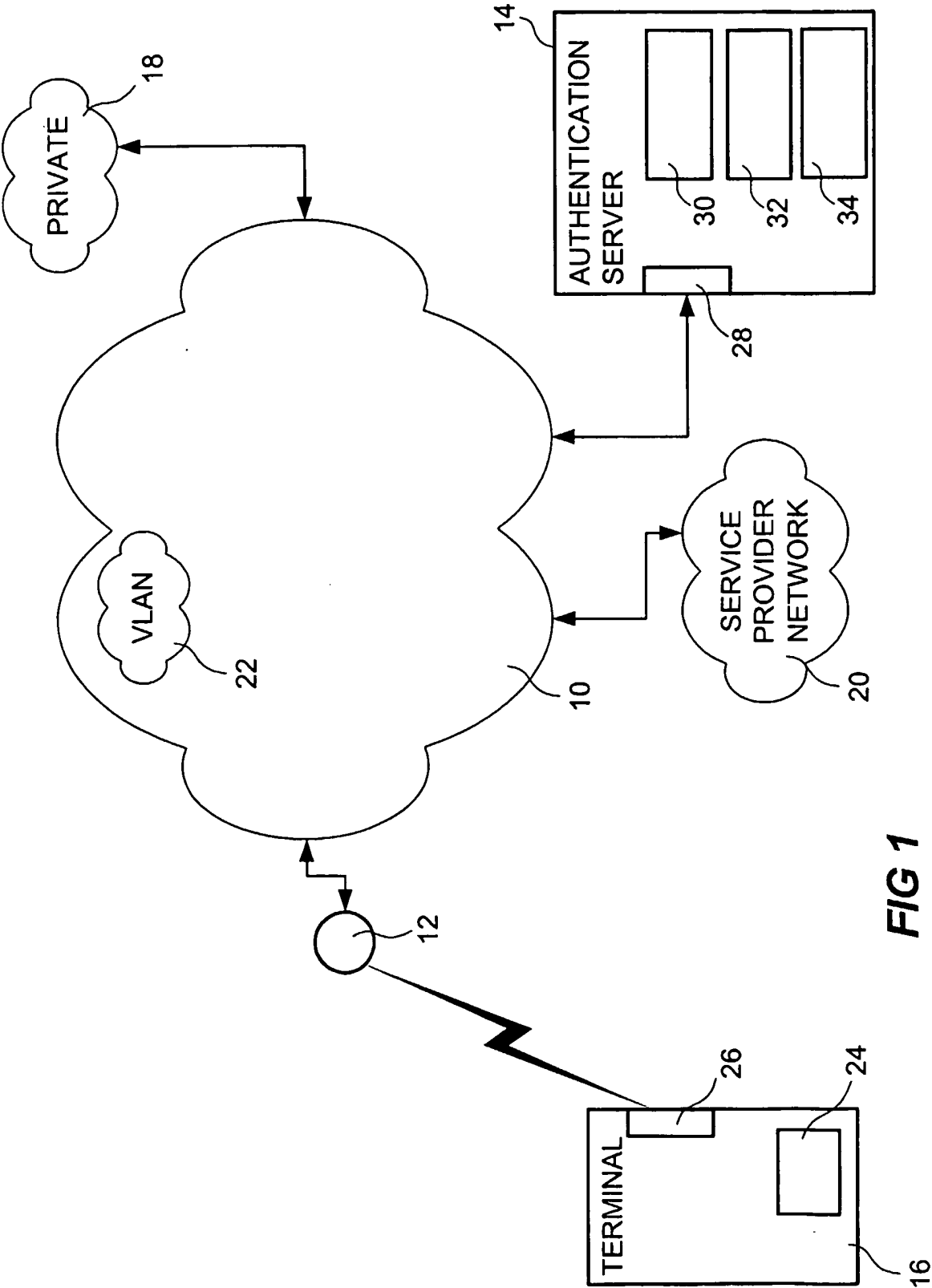
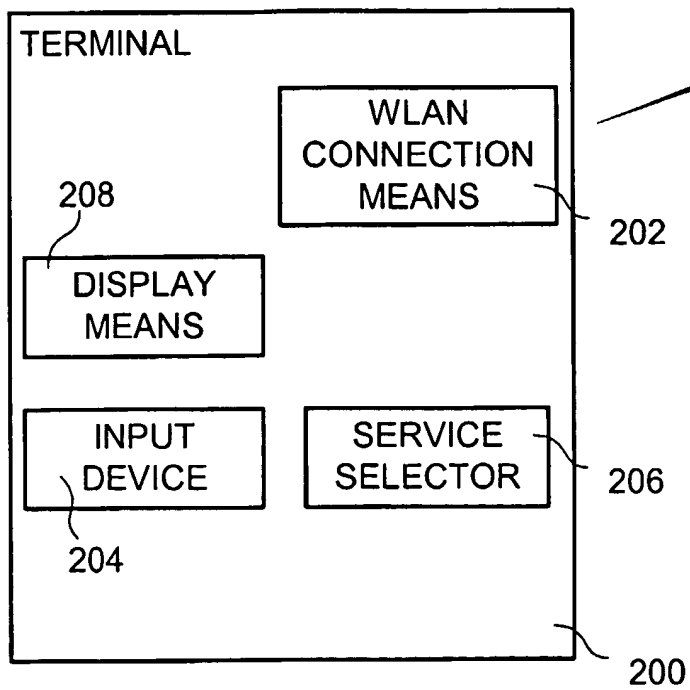
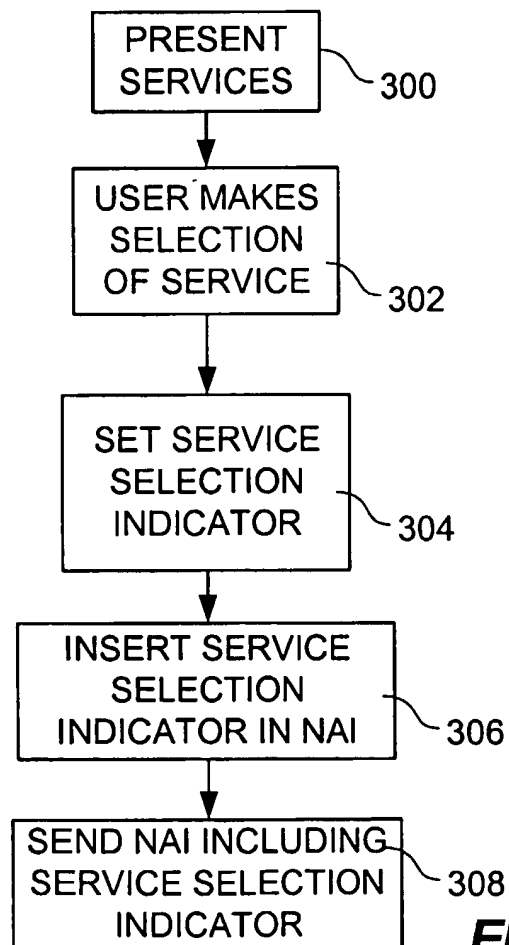
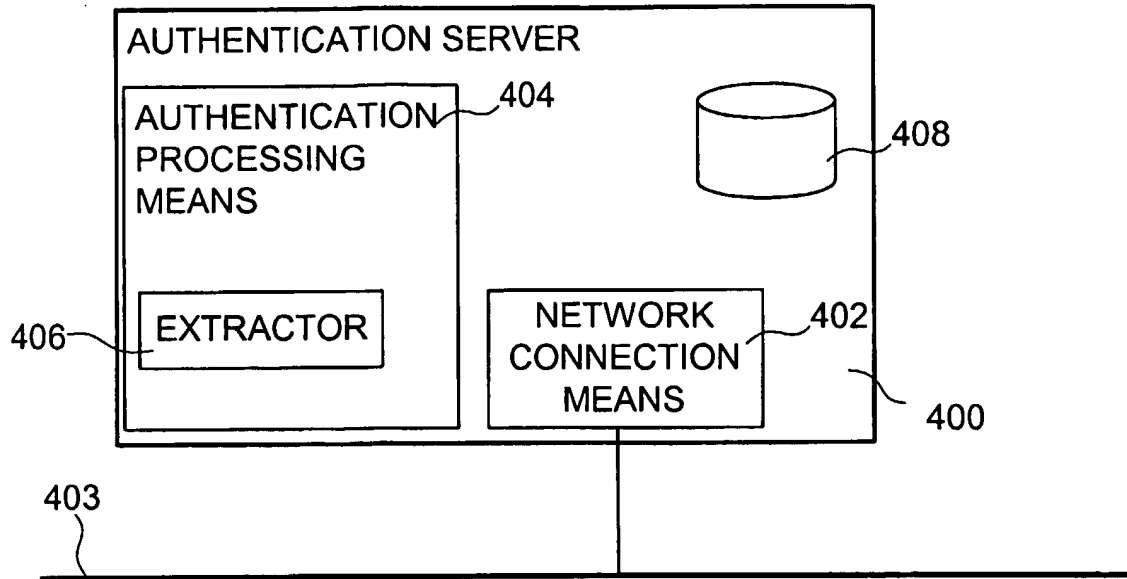
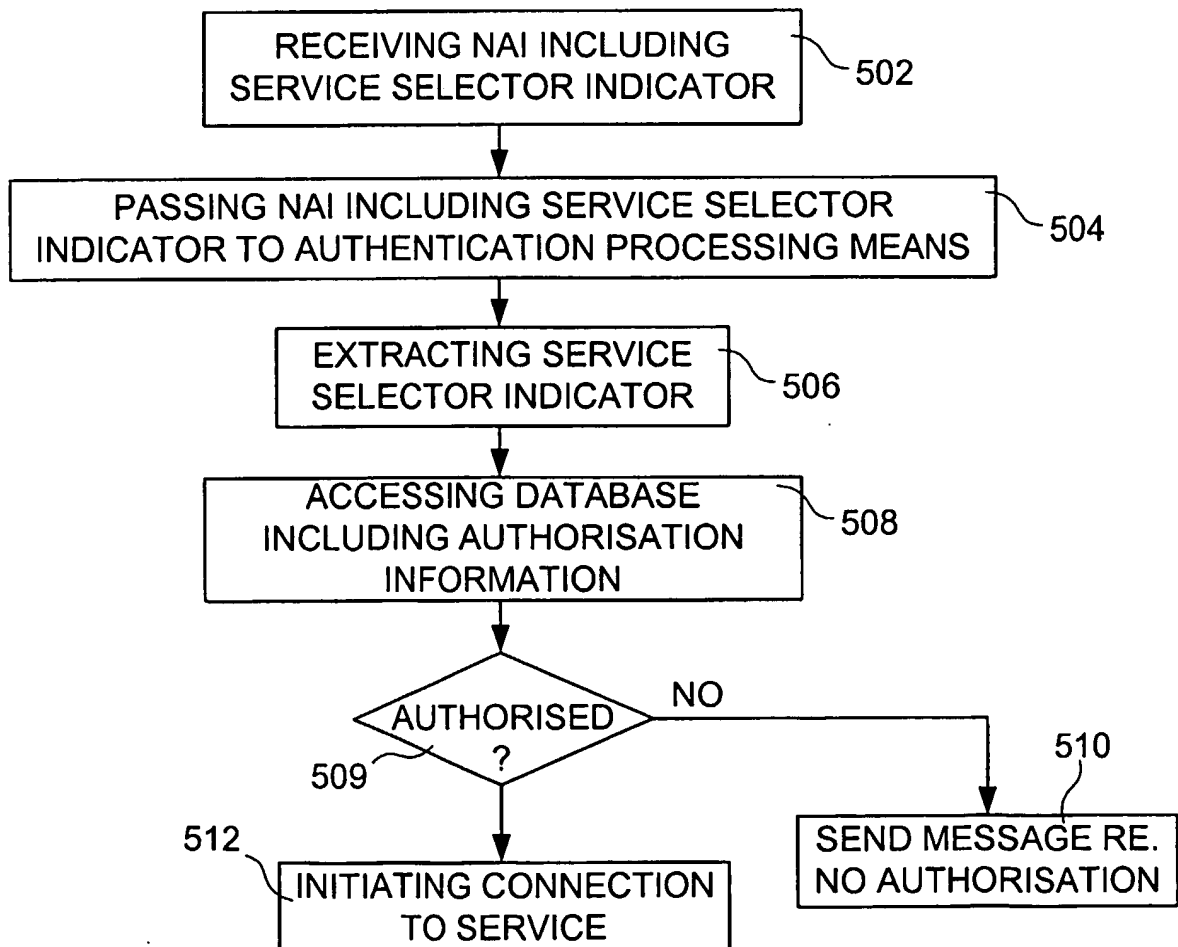


FIG 1

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**FIG 2****FIG 3**

3/4

**FIG 4****FIG 5**

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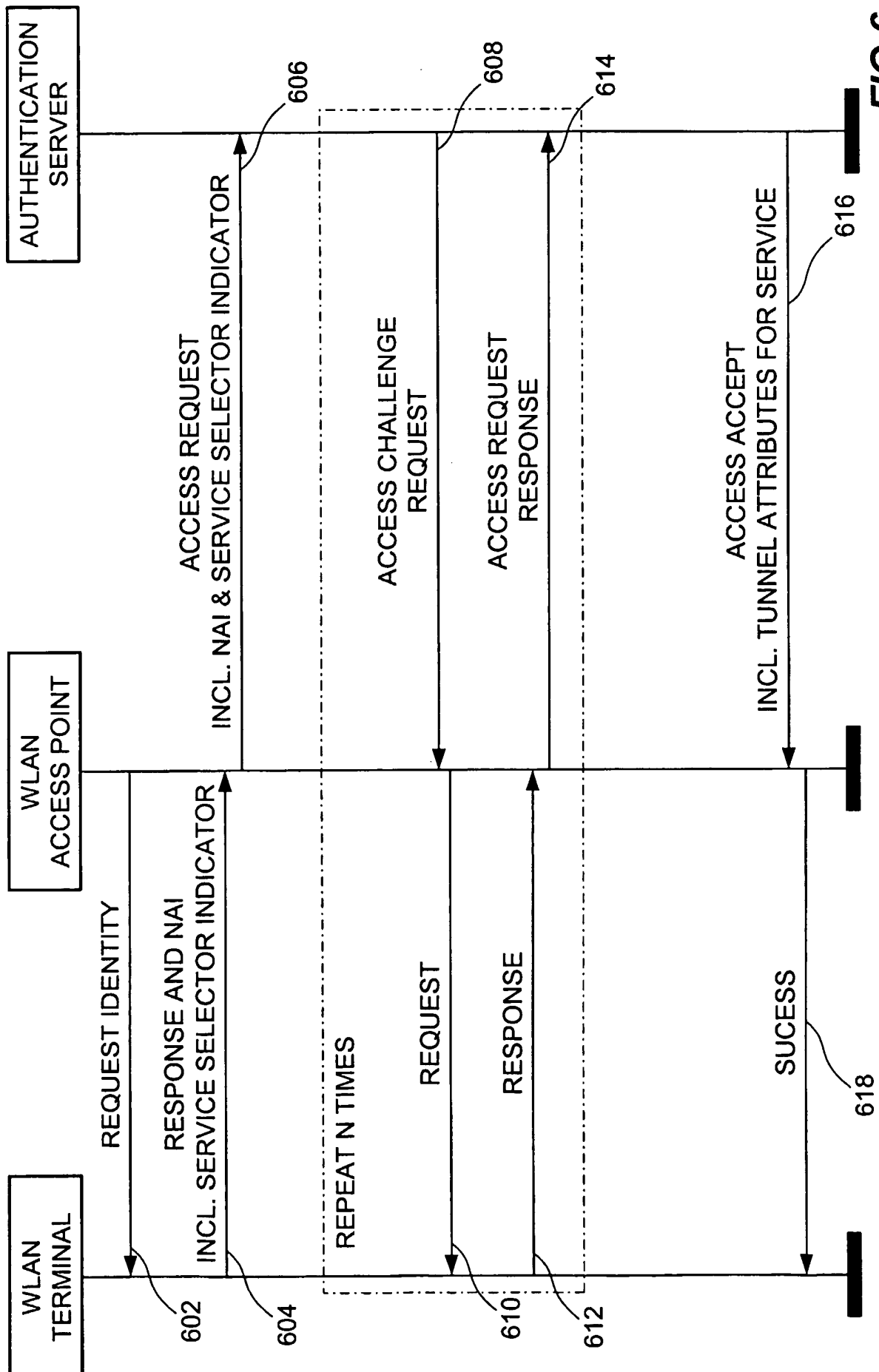


FIG 6

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04L 12/28, H04Q 7/38  
According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G06F, H04L, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CALHOUN, P. et al: Mobile IP Network Access Identifier Extension for IPv4. Network Working Group, Request for Comments: 2794, [online], March 2000, [retrieved on 2002-11-08]. Retrieved from the Internet: <a href="http://www.ietf.org/rfc/rfc2794.txt">http://www.ietf.org/rfc/rfc2794.txt</a> See page 1, line 10 - line 21; page 2, line 1 - line 6  --	1-28
Y	Cisco Service Selection Gateway. Cisco Systems [online] (c) 1992-2001 Cisco Systems, Inc. See page 2, line 7 - line 8  --	1-28

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search	Date of mailing of the international search report
18 November 2002	19-11-2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer  Ralf Boström/LR Telephone No. +46 8 782 25 00



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB 02/01273

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 0176134 A1 (NOKIA CORPORATION), 11 October 2001 (11.10.01), page 16, line 20 - page 17, line 15, claim 2, abstract  -- -----	1-28

### Information on patent family members

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International application No.

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